Project Number: 6-CO082

Mt Cooee Landfill Expansion, Clutha

Operational Noise Impact Assessment

30 May 2023

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0	Issue to Client
1	Final Issue
2	Update to align with AEE

Contents

Appendices

List of Figures

List of Tables

Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for Clutha District Council ('**Client**') in relation to the preparation of a noise impact assessment to support a Resource Consent Application for the expansion of Mt Cooee Landfill, in Clutha ('**Purpose**'). The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

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Executive Summary

Clutha District Council have engaged WSP to undertake an assessment of the noise associated with a five-cell extension to the Mt Cooee Landfill, in Balclutha.

Activities associated with the landfill extension include earthworks to flatten and grade the ground prior to filling, installation of a liner to control leachate from site, operation of three at-grade landfill cells, and operation of two landfill cells on top of the previous three. Capping and rehabilitation of the site will occur at the end of each cell.

The site is located within a Rural Zone and is designated for use as a landfill. Residential properties are located on Golfers Lane and Archer Street to the north, and across Clutha River and Motocross Park to the west. A rural residential dwelling is located to the southeast of the site.

The Clutha District Plan noise standards have been used to assess noise from the proposed landfill site. The noise standards within the Clutha District Plan use the L_{10} noise descriptor. This has been replaced by the L_{eq} noise descriptor in NZS 6801:2008 and NZS 6802:2008 (which the District Plan refers to), in line with international best-practice. The numerical noise limits have not been changed, but the noise descriptor has been changed to L_{eq} for our assessment.

The earthworks and lining installation, along with capping and site rehabilitation have been considered as construction activities. As these activities will occur between 0730 and 1800 hours Monday to Saturday, a 70 dB $L_{Aeq,15\ min}$ and 85 dB L_{AFmax} noise limit applies.

All other activities are considered operational, and therefore a 55 dB $L_{Aeq,15\ min}$ noise limit applies at the boundary or notional boundary of adjacent properties, along with a 65 dB $L_{Aeq,15min}$ site boundary noise limit at the landfill site.

The predicted noise levels for construction noise are lower than the construction noise criteria. Therefore, noise effects associated with this activity are predicted to be acceptable.

Operational noise when assessed at the site boundary or notional boundary of any adjacent site is predicted to achieve the operational noise limits.

A non-compliance is predicted at the entry of the site due to vehicles arriving and departing the site (as these need to cross the boundary). This non-compliance is predicted for an approximate 15 metre length of the site boundary. A site boundary limit is typically used to minimise any effect to potential future noise sensitive receptors (such as a residential dwelling). The boundary of the non-compliance is adjacent to the road corridor, which in turn is adjacent to the Clutha River. Assessing the noise at the boundary of the nearest site results in noise levels less than the 65 dB $L_{Aeq,15min}$ noise limit.

Therefore, noise effects associated with the operation of the proposed landfill extension are acceptable.

1 Introduction

WSP has been appointed by Clutha District Council (CDC) to provide acoustic consultancy services to assess noise effects associated with the five cell expansion to Mt Cooee Landfill (The Landfill), in Balclutha.

The Landfill is currently the only sanitary landfill within the Clutha District, and handles the Councils kerbside collection service, ten waste transfer stations across the district, and provides a pay-to-dump service directly. The Landfill services residential, commercial and industrial waste.

The existing Class 1 landfill (as defined in the WasteMINS Technical Guidelines to Land 2022 document) processes around 9,000 tonnes of refuse each year and includes a waste diversion facility for recycling and green-waste disposal.

The current landfill has been operating since 1985. The landfill is currently operating under several existing resource consents held by the Otago Regional Council (ORC), which expire on 1 October 2023. The existing landfill cells are nearing the end of their life with capacity expected to be reached in approximately 2025. An expansion on the Landfill site is required for it to continue to operate.

This report outlines relevant acoustic criteria for noise associated with the operation of the five new waste cells associated with the Landfill and assesses the potential effects against the acoustic criteria. Noise associated with the current landfill and/or vibration is outside the scope of this report.

This noise impact assessment is based on our correspondence with the applicant to date, along with the following documentation:

- Front of site overall plan titled *Transfer Station and Resource Recovery Centre; Overall Site Plan*, work in progress issue, prepared by WSP, and printed 15 March 2023
- Landfill management plan titled *Mount Cooee Landfill Management Plan:2022*, ID 743394, prepared by Clutha District Council, and dated August 2022.
- Landfill presentation titled *Mt Cooee Landfill Concept – February 2023 V3*, version 3, prepared by WSP and dated February 2023.
- Land terrain survey data for the working areas of the site received by email from Lawrence Bishop on behalf of TL Survey Services Ltd, and received on 10 March 2023

This report is necessarily technical in nature and therefore, a glossary of acoustic terminology is included in Appendix A to assist the reader.

2 Project Background

This section outlines the location of the site, proposal, and nearest sensitive receptors.

2.1 Location

The Landfill is located at 69 Kaitangata Highway, in Balclutha. The site, along with the properties directly to the north, east, and south are zoned Rural in the Clutha District Plan (Planning Map U5), with the site to the west (Kaitangata Highway) zoned Formed Road. The site is designated D120 under the Clutha District Plan as Mt Cooee Landfill (Rural).

The closest residential properties are located in the Urban zone to the north (yellow area in Figure 2.1), and in the Rural zone to the south. Across Clutha River is Balclutha Airport and a motocross park. The Main South Railway Line for freight trains runs across the north boundary of the site. Balclutha Golf Club is also located to the north of the site

Sites further northwest of the Landfill are zoned Transitional, with residential properties on Golfers Drive, Arthur Terrace, and Lincoln Terrace zoned Urban.

The location of The Landfill, surrounding area, and site zoning are presented in Figure 2.1.

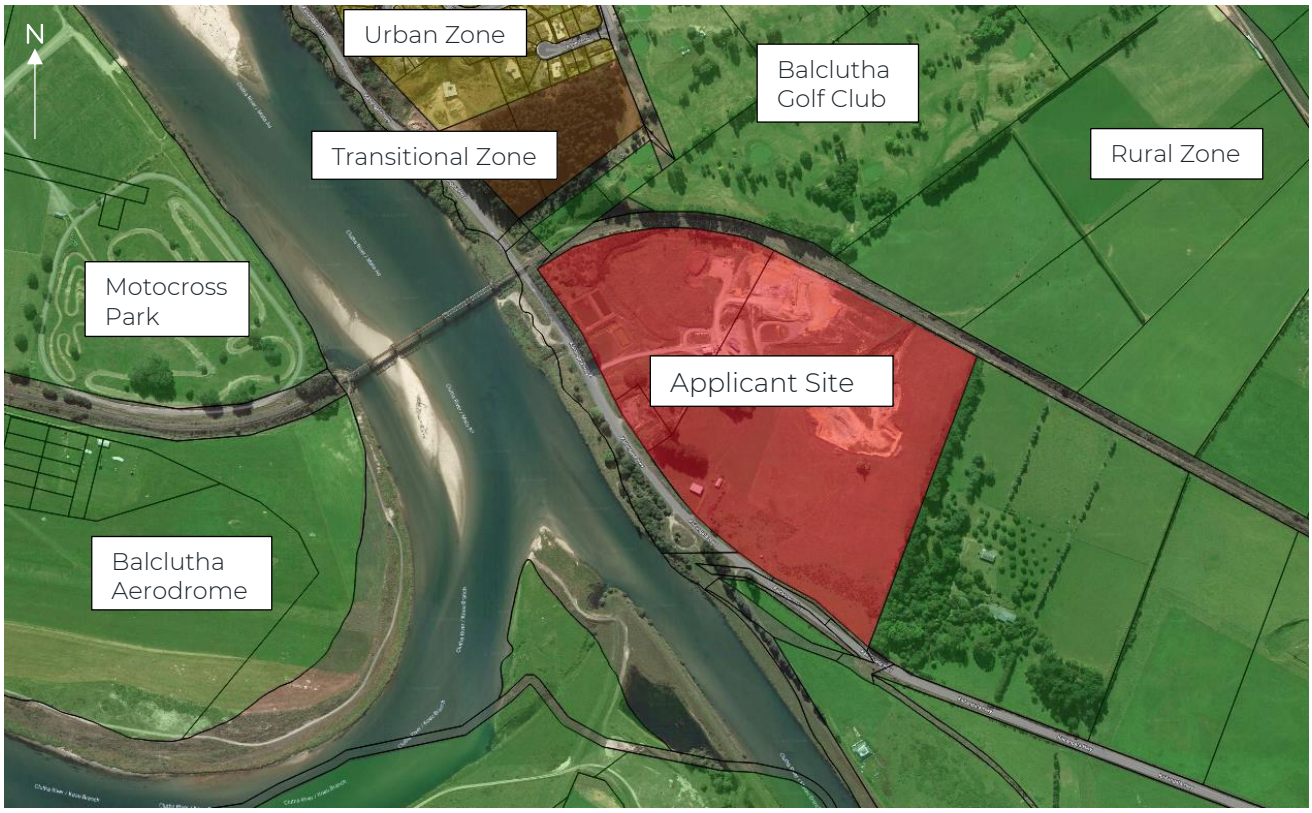

Figure 2.1 Site location plan

2.2 Proposed Development

The proposal is to increase the capacity of the landfill site by the construction and use of a five-cell landfill in the eastern portion of the existing site. This project will also develop a new Resource Recovery Centre and Transfer Station . This removes public access to the working landfill face. Commercial rubbish vehicles will still access the landfill face directly.

The construction of the new landfill will include grading and levelling the site, which will slope from northeast (at approximately 19.5 metres above sea level) down to the west (at 14.5 metres above sea level). A total of approximately 64,200 m^3 of cut is required to install the three base

cells, with 6,000 m^3 used for fill to level the cell sites. Construction of a liner will be required to capture leachate from the new landfill. The liner includes a liner subgrade on the bottom with 600 mm of compacted soil above, and two membranes over the compacted soil. Further information on the liner construction and area installed can be found in the wider planning application.

The finished ground level prior to the new landfill being operated is shown in Figure 2.2.

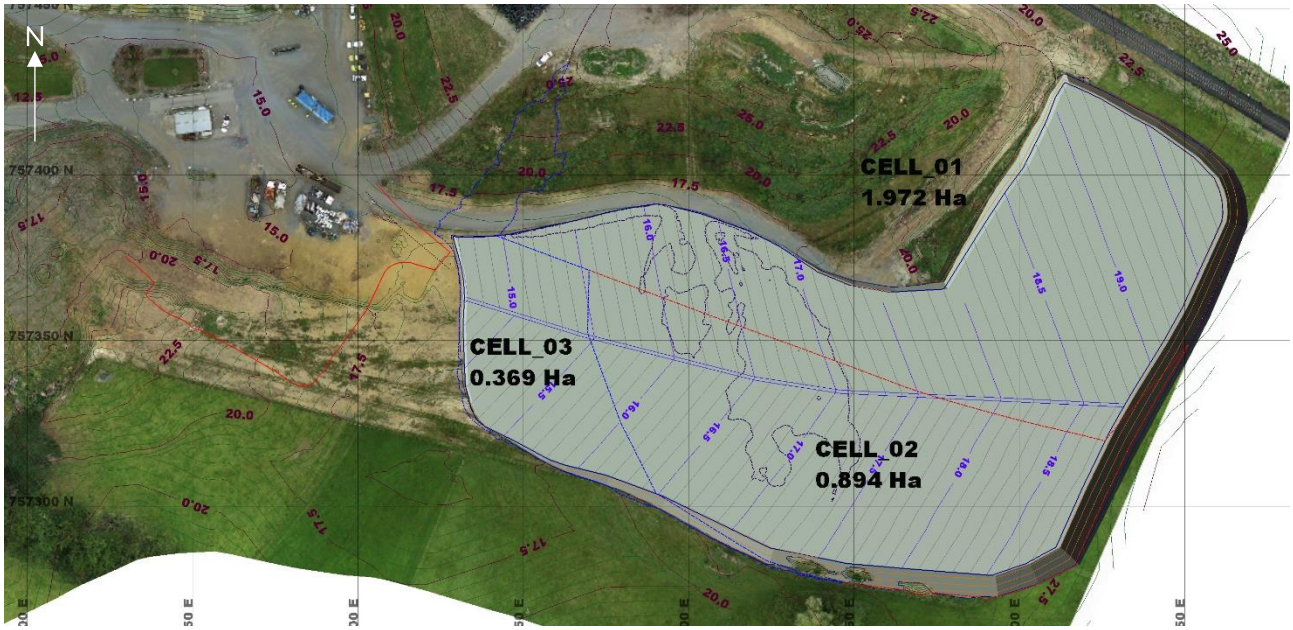

Figure 2.2 Final constructed ground level of new landfill cells

Three of the sites will start at base level with two further cells overtop of the three proposed cells. Over the five cells, this provides a capacity of approximately 320,400 m^3 of usable landfill volume, separated into the following:

- Cell 01: 59,200 m^3 capacity
- Cell 02: 62,200 m^3 capacity
- Cell 03: 79,400 m^3 capacity
- Cell 04: 69,200 m^3 capacity
- Cell 05: 50,400 m^3 capacity

Cell 1, 2, and 3 will be constructed up to a height of 27.5 metres above sea level which includes the capping. Cell 4 will be constructed up to 31 metres above sea level, with cell 5 being constructed up to 36 metres above sea level.

Each landfill cell will take approximately six years to fill. Each of the six cells are shown in Figure 2.3.

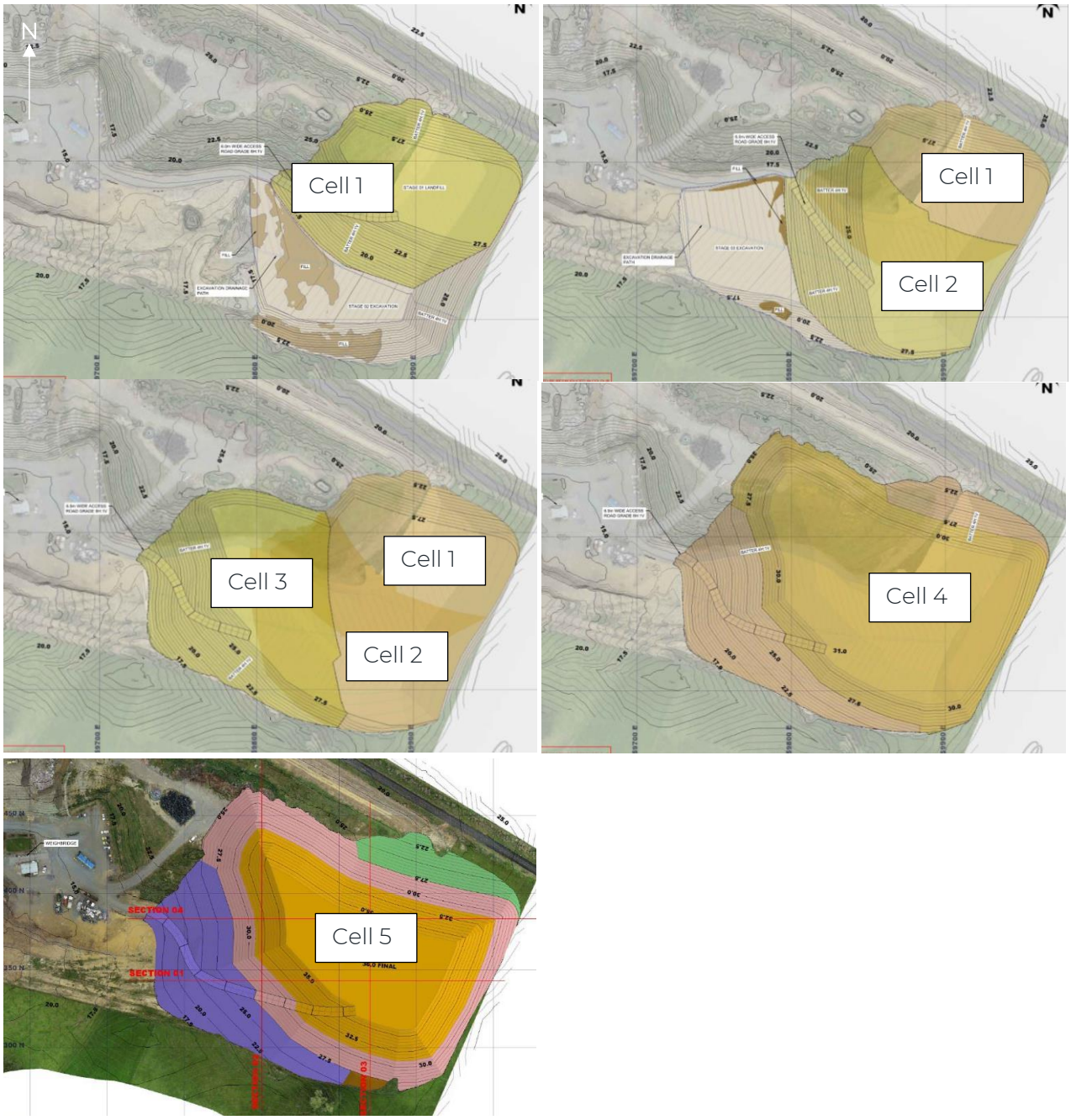

Figure 2.3 Cell development

In addition to the new cells, a new public area will be developed to include:

- Resource recovery area.
- Public drop-off recycling area.
- Public access landfill, organics, and bulk landfill item drop-off/push area.

The site plan showing the new public area is provided in Figure 2.4.

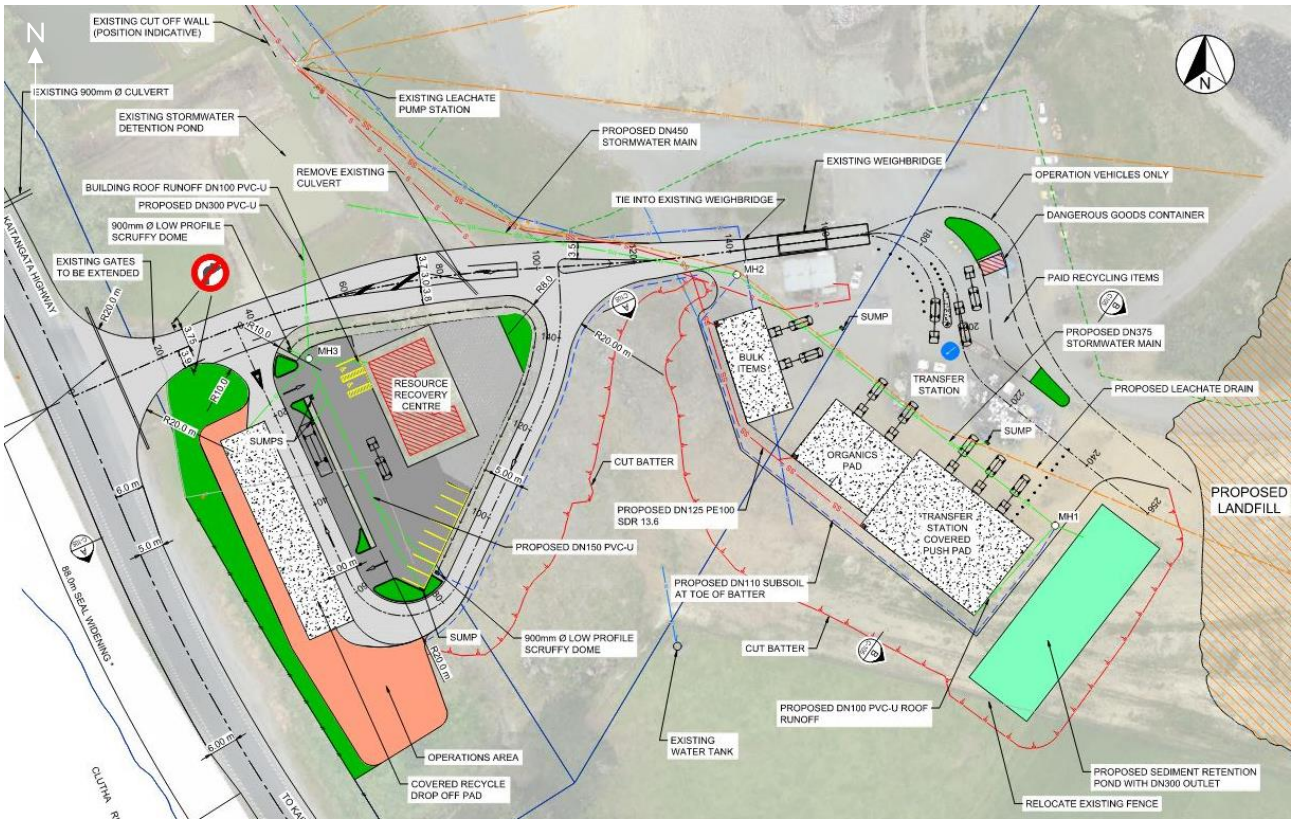

Figure 2.4 New proposed public area

The landfill currently operates as outlined in the table below. The hours of operation are not proposed to change under this application.

Table 2.1 Hours of operation of the landfill

Days	Operating Hours
Monday to Friday	0800 to 1630
Saturday and Sunday	1000 to 1630
Labour Day	0800 to 1630
ANZAC Day	1330 to 1630
Good Friday, Christmas Day, Boxing Day, New Year's Day, January 2	Closed

2.3 Noise Sensitive Receptors

Generally, the adjacent properties are separated from the site by distance. Residential dwellings are located to the north and west, with rural zoned properties located to the east

The locations of the noise sensitive receptors are outlined in Figure 2.5.

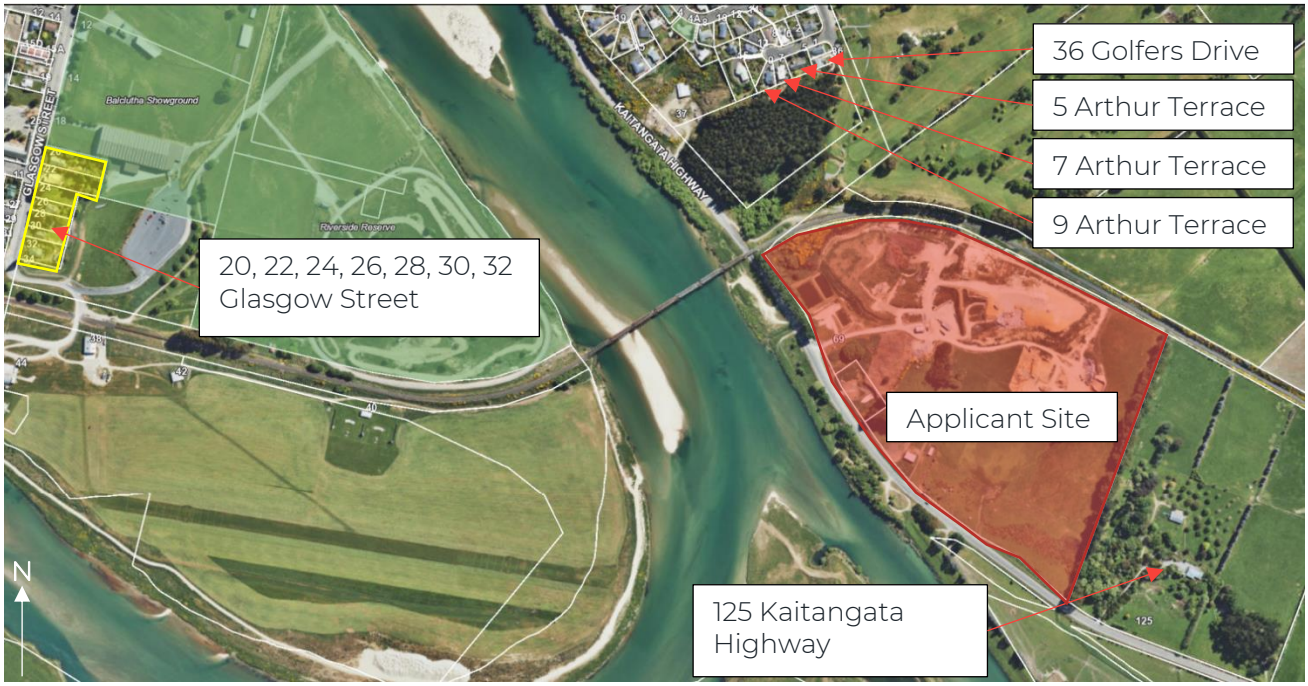

Figure 2.5 Location of nearby noise sensitive properties

The distance the properties given in Figure 2.5 to the proposed landfill cells is provided in Table 2.2.

Table 2.2 Closest properties and distances

Property	Approximate distance To Receptor (metres)
36 Golfers Drive	470
5 Arthur Terrace	475
7 Arthur Terrace	485
9 Arthur Terrace	485
125 Kaitangata Highway	210
20, 22, 24, 26, 28, 30, 32 Glasgow Street	1,200

3 Acoustic Criteria

Section 16 of the Resource Management Act (RMA) requires occupiers of land to ensure any noise generated is of a reasonable level. Guidance as to a reasonable level of noise at adjacent noise sensitive receivers is outlined below.

The CDC District Plan provides guidance as to acceptable noise levels based on land-use within certain areas or zones.

The site is located within a Rural Zone with receiving zones within the Urban Zone. The applicable noise rules which relate to the landfill under the CDC District Plan are reproduced below.

'3.13.4. Rules NSE.1 Measurement

(i) Except where otherwise stated, all noise will be measured and assessed in accordance with the requirements of New Zealand Standards NZS 6801:2008 "Acoustics – Measurement of environmental sound" and assessed in accordance with NZS 6802:2008 "Acoustics – Environmental noise".

(ii) The measurement period shall be not less than 15 minutes and the L10 level in dBA is defined as that level of sound equalled or exceed for 10% of the measurement period.

The L_{10} noise descriptor was replaced in the 1999 version of NZS 6801 and NZS 6802 standards to the L_{Aeq} noise metric to align international best practice. L_{Aeq} is retained as the main noise descriptor in the 2008 version of the standard, as outlined in the *Forward* section of NZS 6802:2008.

'3.13.4. Rules Construction Noise

Noise resulting from construction which is ancillary to the principal use if the site shall meet with the limits recommended in, and shall be measured and assessed in accordance with, New Zealand Standard NZS 6803 1984 The Measurement and Assessment of Noise from Construction Maintenance and Demolition Work. Any activity that does not comply with this rule shall be considered as a discretionary activity in accordance with the criteria set out in method NSE.2.'

We note that the 1984 version of NZS 6803 was a provisional version of the standard. This Standard was issued as technical revision in 1999, and is the latest version, NZS 6803:1999. The key change from NZS 6803P:1984 to NZS 6803:1999 was the update to the L_{eq} noise descriptor to align with international best-practice.

'4.1.4 Rules, Rule RRA.10 Noise Standards

(i) The provision of Section 3.13 shall apply unless otherwise stated by these rules

(ii) Corrected noise levels (L10) at the boundary of a site shall not exceed 65 dBA provided that corrected noise levels (L10) shall not exceed the following limits at the boundary of any Urban Transitional or Rural Settlement Resource Area or at the notional boundary of any residential, hospitality, tourist, educational or health activity site located in the Rural Resource Area provided this rule does not apply to temporary shot duration emissions of noise that are a one off occurrence:

Weekdays and Weekends

7am to 10pm	*L10*	*55dBA*
10pm to 7am	*L10*	*45 dBA*

"Notional boundary" in respect of a residential activity means a line 20 metres from the façade of the building or the legal boundary of the site on which the building is located where the boundary is closer to the building than 20 metres.

"Notional boundary" in respect of hospitality, tourist, educational, or health activities means the legal boundary of the site.

(iii) Where an activity is established and a new activity locates where it will be affected by the 65dBA noise maximum level (referred to in (ii) above), it shall be the responsibility of the developer of the newly located activity to ensure that buildings associated with that use are designed in such a manner that the day time and night time noise levels are met within that new activity.'

We note that under the latest NZS 6801 and NZS 6802 standards (2008), as referenced by the Clutha District Plan, the L_{10} noise descriptor has been replaced by the L_{eq} noise descriptor in line with international best-practice.

3.1 Discussion on appropriate noise limits

3.1.1 Construction Noise

NZS 6803P:1984 was revised in 1999. Therefore, in line with best practice we have assessed construction activity in accordance with the noise limits included within the 1999 version of the Standard.

3.1.2 Operational Noise

The CDC District Plan noise limits use a noise descriptor (L_{10}) which has been superseded within that latest noise standards in New Zealand.

In line with current New Zealand Standards and international best-practice, we are recommending that the noise descriptor L_{eq} is used for this assessment. The numerical noise levels are not to be changed.

The proposed noise limits and descriptors for the proposed landfill are provided in Table 3.1.

Table 3.1 Proposed noise limits

Time	Noise Limit	Location	Assessment Period
0700 to 2200 hours Monday to Sunday	55 dB $L_{Aeq,T}$	Property boundary of Transition or Urban Zones.	15 minutes
2200 to 070 hours Monday to Sunday	45 dB $L_{Aeq,T}$	Notional boundary of Rural Zone	
At all times	65 dB $L_{Aeq,T}$	Site boundary	

The predicted L_{10} noise levels have also been provided for completeness.

4 Construction Noise Assessment

This section outlines the assessment methodology, predicted noise levels and effects assessment of the construction of the landfill and rehabilitation of landfill once complete.

4.1 Methodology

Earthworks to flatten the site, removal of topsoil, installation of a liner along with capping/rehabilitation of each cell is work which is of limited duration and will be undertaken once. Therefore, this activity is considered "construction work" as outlined in Section 1 of NZS 6803:1999.

We have therefore considered the earthworks including the installation of a liner to prepare the landfill extension area for use as a landfill, along with the rehabilitation/capping as construction activities.

The two construction scenarios that are being assessed are below:

1 Earthworks required to level the site prior to any landfill activities including the installation of the liner
2 Rehabilitation/capping of the landfill once a cell is full.

SoundPLAN (Version 8.2) 3D computational noise modelling software has been used to assess the transmission of noise from the proposed extension of the landfill to adjacent properties, based on the methodology contained within ISO 9613-2 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*. The assessment considers attenuation due to distance, terrain and absorption by the atmosphere and ground. The assessment assumes worst-case downwind conditions in all directions from all sources, which provides a conservative approach for assessment.

Table 4.1 presents the noise modelling parameters adopted for this assessment.

Table 4.1 Noise modelling parameters

Parameter	Value	Comments
Terrain Contours	0.1 metre vertical contours of site 20 metre vertical contours of surrounding land	Site: TL Survey Services Ltd, received 10 March 2023 Surrounding area: Toitū Te Whenua LINZ
Landfill Extension area	Location and height of cells	WSP waste consultants
Building locations	Building location and height	Location: Toitū Te Whenua LINZ Height: Google Maps street view
Site parcels	location	Toitū Te Whenua LINZ
Ground Absorption Coefficient	0.9	-
Number of Reflections	3	-
Assessment Height	1.5 m single story dwellings 4.5 m for two-story dwellings	-

We have undertaken our analysis based on all construction equipment operating concurrently for an entire 15 minute assessment period. We have assumed that all equipment would operate over the area where the new cells would be constructed only, apart from road trucks which would enter and exit the site via the main entry/exit.

It has been assumed that all construction activity will occur between 0730 and 1800 hours Monday to Saturday only.

The predicted noise levels include reflections from building facades.

The L_{AFmax} was determined by calculating the noise levels from the single loudest item of plant, operating at the nearest location on the proposed landfill location to that property.

4.2 Noise Sources

Table 4.2 provides a list of the expected equipment to be used during construction, the associated sound power, and number of units that are likely to be used.

The equipment selection and associated sound power levels are based on BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites*, NZS 6803:1999 *Acoustics – Construction noise*, or previous measurements of similar equipment. The analysis and assessment have been undertaken on the basis that the levels presented in Table 4.2 are not exceeded by the equipment or plant.

Light construction works (such as light handheld tools, manual digging, line painting etc.) are also expected to occur on site. These activities are not considered to generate significant levels of noise or vibration and therefore have not been included, unless otherwise specified.

Table 4.2 Noise data of noise sources

Noise Source	Quantity	Sound Power Level (L_{wA})	Maximum noise level (L_{wAFmax})
Articulated dump	1	104 dB	120 dB
Road truck and trailer	6 movements in 15-min period	104 dB	120 dB
Dozer	2	109 dB	114 dB
Wheeled loader	2	110 dB	115 dB
Vibratory roller	2	105 dB	112 dB

It is assumed that this equipment will operate concurrently over the entire construction duration.

4.3 Predicted Noise Levels

The predicted noise levels from construction activity on site at each of the closest receptors is presented in Table 4.3.

Table 4.3 Predicted construction noise levels

Property	Earthworks Predicted Noise Level 1m from Façade ($L_{Aeq\ (15min)}$)	Rehabilitation Predicted Noise Level 1m from Façade ($L_{Aeq\ (15min)}$)	Predicted Maximum Noise Level (L_{AFmax})	Criteria	Complies?
36 Golfers Drive	51 dB	52 dB	61 dB	70 dB $L_{Aeq,T}$ / 85 dB L_{AFmax}	Yes
5 Arthur Terrace	50 dB	51 dB	61 dB	70 dB $L_{Aeq,T}$ / 85 dB L_{AFmax}	Yes
7 Arthur Terrace	50 dB	51 dB	61 dB	70 dB $L_{Aeq,T}$ / 85 dB L_{AFmax}	Yes
9 Arthur Terrace	50 dB	51 dB	61 dB	70 dB $L_{Aeq,T}$ / 85 dB L_{AFmax}	Yes
125 Kaitangata Highway	55 dB	54 dB	69 dB	70 dB $L_{Aeq,T}$ / 85 dB L_{AFmax}	Yes
20, 22, 24, 26, 28, 30, 32 Glasgow Street	35 dB	36 dB	53 dB	70 dB $L_{Aeq,T}$ / 85 dB L_{AFmax}	Yes

Noise levels are predicted to comply with the construction noise limits outlined in NZS 6803:1999.

4.4 Noise Effects from Construction

We have the following comments regarding noise effects from construction activities:

- The predicted average noise levels (L_{Aeq}) are a worst-case level where all equipment is operating concurrently at the closest point for the entire 15 minute assessment period. It is unlikely that this will occur in reality, and therefore noise levels are likely lower than those predicted.
- The predicted noise levels are below the general operational noise limits assessed at the boundary or notional boundary of adjacent sites.
- The predicted noise levels are unlikely to disrupt conversation outdoors.
- The earthworks associated to level and grade the site, along with install the liner are predicted to take approximately 6 months, based on estimates from other similar sites. The final capping, including associated rehabilitation and landscaping once all cells are full is proposed to take approximately 6 months.

Based on the predicted noise levels, we expect that noise from construction activities on site will be acceptable.

5 Operational Noise Assessment

This section outlines the assessment methodology, noise sources, predicted noise level, and effects assessment for the operation of the landfill over the five cells.

5.1 Methodology

Operational noise from the Landfill has been assessed using SoundPLAN (Version 8.2) 3D computational noise modelling software, as outlined in Section 4.1. An assessment period of 15 minutes has been used for the operational noise assessment.

Noise from commercial and domestic vehicles travelling on site have been calculated based on a moving point source operating from the entry of the site to the destination (recycling, drop-off, or landfill face) and then back, exiting the site, assuming a speed of 20 km/hr.

CDC provided WSP a monthly breakdown of commercial and domestic vehicles across the weighbridge. Based on the data provided, the maximum number of vehicles within the period are provided below:

- Commercial: 91 vehicles on the worst-case day
- Domestic vehicles to landfill: 7 vehicles on the worst-case day
- Domestic vehicles to recycling: 9 vehicles on the worst-case day

These numbers have been used as worst-case vehicle numbers over a worst-case day.

5.2 Assessment Scenarios

An assessment has been undertaken of the operation as the landfill develops over the five cells. The activity which occurs during the operation of each cell is considered the same, only the location of the sources is changed, depending on the location of the cell.

Predicted noise levels have been undertaken during the start of the fill of the cell and at the end of the fill of the cell.

For each cell, we have assessed a worst-case 15-minute period where:

- The dozer is operating continuously at the landfill face,
- A loader/dozer is operating continuously at the public drop-off area,
- Commercial rubbish trucks enter site and discharge waste at the landfill face before departing site,
- Domestic vehicles entering and exiting site to drop off recycling, and
- Domestic vehicles entering and exiting site to drop off waste.

5.3 Proposed Noise Sources

A site visit was undertaken on 11 November 2022 of the existing Mt Cooee landfill to measure activity from the existing equipment used on site. It is understood that this equipment will be relocated to the landfill extension once operating. Noise from the existing dozer and loader were measured along with commercial and domestic vehicles entering and exiting site, commercial vehicles tipping loads, and recycling being dropped off. Noise measurements undertaken during this site visit were used in this analysis.

The sound level of the equipment proposed on the site within the assessment scenario is provided in Table 5.1.

Table 5.1 Noise data of noise sources

Noise Source	Quantity	Sound Power Level (L_{wA})	Notes
Dozer operating on landfill*	1	109 dB	-
Dozer/loader operating at public drop-off *	1	102 dB	-
Rubbish trucks on internal roads*	46 movements	97 dB	Based on quarter of daily vehicles in worst-case 15-min period. Measurements undertaken of a rubbish collection truck on unsealed road.
Domestic vehicles to recycling*	6 movements	89 dB	Based on quarter of daily vehicles in worst-case 15 min period. Measurements undertaken of a SUV towing a full trailer on unsealed road.
Domestic vehicles to landfill*	4 movements	89 dB	Based on quarter of daily vehicles in worst-case 15 min period. Measurements undertaken of a SUV towing a full trailer on unsealed road.
Trucks reversing and discharging*	23	100 dB	Based on quarter of daily vehicles in worst-case 15-min period. This level includes rubbish collection truck reversing, unloading rear container, and driving off.
Domestic vehicles idling whilst unloading**	60 sec idling each vehicle	65 dB	-
Glass being dropped into metal recycling bins*	10 sec drop, 6 drops	120 dB	-

* Source: Equipment measured on site.

** Source: WSP database of previously measured equipment.

5.3.1 Special Audible Characteristics and Duration Adjustment

In accordance with NZS 6802:2008, where an activity has a distinctive character which may affect its subjective acceptability (Special Audible Characteristic, SAC), a 5 dB penalty shall apply.

During our site visit, trucks reversing on the landfill face were observed to have tonal reversing alarms. We have therefore allowed a + 5dB penalty to all trucks reversing on site. While noise measurements of equipment on site did not produce tonal characteristics, we have allowed a +5dB penalty to all loaders and dozers on site.

We have predicted a worst-case noise level from peak activity within a worst-case 15-minute period. Therefore, we have allowed a -5dB duration adjustment as activity on site is will not operate at this level for the entirety of the daytime period.

5.4 Predicted Noise Levels

Table 5.2 outlines the predicted noise levels from the extension of the landfill along with a comparison against the acoustic criteria.

Table 5.2 Predicted noise levels of the proposed landfill extension

Property	Predicted Noise Level (dB $L_{Aeq\ (15min)}$)					Criteria	Complies?
	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5		
Applicant's site boundary	Up to 69	Up to 69	Up to 69	Up to 69	Up to 69	65 dB $L_{Aeq(15\ min)}$	No
Transitional Zone boundary	43-44	43-45	44-45	44-44	43-44	55 dB $L_{Aeq(15\ min)}$	Yes
36 Golfers Drive	44-45	43-44	44-45	45-45	45-45	55 dB $L_{Aeq(15\ min)}$	Yes
5 Arthur Terrace	43-44	43-44	44-45	44-44	44-44	55 dB $L_{Aeq(15\ min)}$	Yes
7 Arthur Terrace	42-43	42-43	43-43	43-43	43-43	55 dB $L_{Aeq(15\ min)}$	Yes
9 Arthur Terrace	42-42	42-42	43-43	43-43	43-43	55 dB $L_{Aeq(15\ min)}$	Yes
125 Kaitangata Highway	36-42	37-44	37-42	44-45	45-47	55 dB $L_{Aeq(15\ min)}$	Yes
20, 22, 24, 26, 28, 30, 32 Glasgow Street	29-29	29-29	30-30	30-29	29-30	55 dB $L_{Aeq(15\ min)}$	Yes

Noise levels are predicted to comply with the noise criteria, apart from the site boundary requirements.

Properties further away than those outlined above would be exposed to lower noise levels.

The predicted L_{10} noise levels for compliance with the CDC District Plan noise standards are provided in Appendix B.

5.5 Discussion of Effects

We have the following comments regarding the predicted noise levels:

- A range of noise levels are provided. The lowest of the range is when operation is at the start of the filling of the cell when adjacent properties are screened by the existing terrain of the site. The higher noise levels in the range are at the end of filling the cell when sources are above existing ground height and are unlikely screened by the existing terrain.
- Subjectively, the noise generated at the landfill when received at the Glasgow Street properties are unlikely to be audible over the existing ambient noise of the area.
- Noise levels at the Golfers Drive and Arthur Terrace properties is likely to be barely audible over the existing ambient noise level. The level of noise subjectively will not likely disrupt conversations or impact on quiet activities (such as reading or working) outdoors. The predicted noise levels are likely lower than those already received at these properties from the existing landfill site, as the proposed cells are located further away from these properties and are likely screened by the landfill are which is currently being filled.
- The above noise levels are a worst-case assessment. It is likely that for the majority of the operation of the landfill, noise levels will be below those predicted above.
- The predicted noise levels from the operation of the landfill extension are below the noise criteria assessed at the boundary or notional boundary of all adjacent sites.
- There is a 4 dB non-compliance with the 65 dB $L_{Aeq,15min}$ boundary noise limit. This exceedance occurs for a 15 metre length at the access road to the site, as shown in Figure 5.1.

Figure 5.1 Noise Contour location around entry of the site

- The exceedance is due to vehicles arriving and departing site.
- A boundary noise limit is generally applied to rural zoned properties to minimise the impact on any new sensitive receptor (such as a residential dwelling) that could be constructed on an adjacent site in future. The exceedance is at the boundary to a road and therefore unlikely

that a residential receptor will be constructed within the road corridor in future. In addition, across the road corridor is Clutha River. Therefore, the closest nearest boundary is that of Balclutha Aerodrome and/or the Riverside Motocross Track. The predicted noise level at the boundary of these sites are as follows:

- Aerodrome: 39 dB $L_{Aeq,15min}$
- Motocross Track: 38 dB $L_{Aeq,15min}$

The predicted noise levels at the boundary of these sites are below both the 65 dB $L_{Aeq,15min}$ site boundary noise limits and 55 dB $L_{Aeq,15min}$ notional boundary noise limits.

- The worst-case predicted noise levels at the other boundaries of the Applicant's site are provided in Table 5.3.

Table 5.3 Predicted noise level on other boundaries of the landfill site

Site Boundary	Worst-Case Predicted Noise Level for any Cell Operation	Criteria	Complies?
North (adjacent to rail corridor, near Transitional Zone land)	46 dB $L_{Aeq,15min}$	65 dB $L_{Aeq,15min}$	Yes
Northeast (adjacent to rail corridor, opposite boundary to Golf Course)	63 dB $L_{Aeq,15min}$*	65 dB $L_{Aeq,15min}$	Yes
Southeast (on boundary with 126 Kaitangata Highway	65 dB $L_{Aeq,15min}$**	65 dB $L_{Aeq,15min}$	Yes

*When landfill is in Stage 1 or 4 and is being filled at nearest location to boundary

**When landfill is being filled at closest location to boundary

Based on the above, when considering the operational hours of the landfill and the worst-case nature of the predicted noise levels, noise effects from the operation of the proposed landfill extension are predicted to be acceptable.

6 Conclusions

WSP has undertaken an assessment of the noise associated with an extension to the Mt Cooee Landfill in Balclutha.

Activity on site is not to change from the current operational hours, which are generally between 0800 and 1630 hours Monday to Friday and 1000 to 1630 hours Saturday and Sunday.

The noise standards in the Clutha District Council's District Plan have generally been used to assess the noise generated by the proposal against. However, the L_{10} noise descriptor used within the Clutha District Plan has been updated to L_{eq} noise descriptor in line with national and international best-practice.

The existing equipment on site along with vehicles travelling on the internal roads were measured. These measurements were used in the noise propagation predictions

Earthworks and liner installation associated with the preparation of the landfill extension, along with the capping/rehabilitation of each cell is considered construction activity as outlined in NZS 6803:1999 due to it being a singular event and of limited duration. Noise assessed in line with NZS 6803:1999 complies with the recommended noise limits within that standard (70 dB $L_{Aeq,15min}$ / 85 dB L_{AFmax} between 0730 and 1800 hours Monday to Saturday). Therefore, the noise effects from construction are considered acceptable.

The predicted operational noise emissions from the proposed landfill extension are predicted to comply with the boundary or notional boundary noise limits at adjacent properties.

Noise assessed at the site boundary doesn't comply near the entry/exit road only, due to vehicles access the site. However, boundary noise levels in rural zones are to protect future sensitive buildings that have not been constructed. When assessed at the nearest property boundary which could be developed (across the road and Clutha River), noise levels are lower than the boundary noise limit.

Therefore, effects from operational noise are considered acceptable.

Appendix A
Glossary

Term	Definition
A-weighting	A frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response.
Ambient noise	The noise level measured in an area in the absence of noise requiring control. Ambient noise is generally measured to determine the noise environment prior to the addition of a new noise.
Audible	Audible refers to a sound that can be heard. There are a range of audibility grades, varying from ""barely audible"", "just audible" to "clearly audible" and "prominent".
Decibel	The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibel scale is useful for acoustical assessments.
$L_{A,max}$	The maximum A-weighted noise level recorded during the measurement period.
$L_{Aeq,T}$	The A-weighted sound pressure level in decibels of a continuous steady sound that has, within a specified time interval, T, the same energy as the sound being measured.
L_{10}	A sound level, just exceeded for 10% of the measurement period, calculated by statistical analysis.
Noise	Noise is typically defined as unwanted, harmful or intrusive sound.
Octave	An octave is the interval between two points where the frequency at the second point is twice the frequency of the first.
Sound Exposure Level (SEL or L_{AE})	The A-weighted sound level which conveys the sound energy of an event over time in a period of 1 second.
Sound Power Level (SWL)	A logarithmic measure of the sound power in comparison to a specified reference level (dB). The parameter is independent of distance from the source.
Sound Pressure Level (SPL)	The basic unit of sound measurement is the sound pressure level. The pressures are converted to a logarithmic scale and expressed in decibels (dB).

Appendix B
Predicted L_{10} Operational Noise Levels

Table B.1 Predicted noise levels of the proposed landfill extension

Property	Predicted Noise Level (dB $L_{Aeq\ (15min)}$)					Criteria	Complies?
	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5		
Applicant's site boundary	Up to 72	Up to 72	Up to 72	Up to 72	Up to 72	65 dB $L_{A10(15\ min)}$	No
Transitional Zone boundary	46-47	45-47	47-48	47-47	47-47	55 dB $L_{A10(15\ min)}$	Yes
36 Golfers Drive	45-46	44-45	46-46	46-46	46-46	55 dB $L_{A10(15\ min)}$	Yes
5 Arthur Terrace	45-45	45-45	46-46	46-46	46-46	55 dB $L_{A10(15\ min)}$	Yes
7 Arthur Terrace	32-32	32-32	32-33	32-32	32-33	55 dB $L_{A10(15\ min)}$	Yes
9 Arthur Terrace	32-32	32-32	32-33	32-32	32-32	55 dB $L_{A10(15\ min)}$	Yes
125 Kaitangata Highway	32-32	32-32	32-33	32-32	32-32	55 dB $L_{A10(15\ min)}$	Yes
20, 22, 24, 26, 28, 30, 32 Glasgow Street	32-32	32-32	32-33	32-32	32-32	55 dB $L_{A10(15\ min)}$	Yes

The boundary exceedance on the site is due to traffic arriving and departing the site only.

Appendix C
Noise Contour Maps

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